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## A revision of the genus *Auaxa* Walker (Lepidoptera : Geometridae, Ennominae)

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**Abstract** All the nominal species of *Auaxa*: *cesadaria* Walker, *sulphurea* (Butler) and *kaluga* Swinhoe, are redescribed, and two new species: *lanceolata* and *mimosina*, are described from continental China and Taiwan respectively.

**Key words** Lepidoptera, Geometridae, *Auaxa*, India, Myanmar, China, Taiwan, Korea, Japan, taxonomy.

*Auaxa cesadaria* Walker, 1860, a new genus and species, was described from China. *A. sulphurea* (Butler, 1878) from Japan and *A. kaluga* Swinhoe, 1900 from Khasia Hills have been treated as geographic varieties of *cesadaria* by Wehrli, 1940: 338. However, a long series of specimens of the genus from Khasia Hills, North Myanmar (=Burma), China, Taiwan, Korea and Japan examined by me revealed that *sulphurea* and *kaluga* are specifically separable from *cesadaria* and that there are two new species from continental China and Taiwan. All the five species will be described or redescribed, with photographs of moths and genitalia.

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Abbreviations: British Museum (Natural History)=BMNH, Zoologisches Forschungsinstitut und Museum A. Koenig=ZFMK, H. Inoue=HI.

### Genus *Auaxa* Walker

*Auaxa* Walker, 1860: 271; Prout, 1915: 329. Type species: *Auaxa cesadaria* Walker, 1860, monotype.

Palpus short, slender, gently upturned, tip of 3rd joint a little projecting from face, antenna in ♂ lamellate, minutely ciliated, in ♀ slenderer, simple, tongue short, hindtibia in ♂ dilated, containing tuft of white hair, in both sexes with two pairs of short spurs. Forewing with apex falcate, both wings with termen weakly crenulate. Forewing with  $R_1$  and  $R_2$  long-stalked, the stalk connected with Sc,  $R_2$  connected with stalk of  $R_3$  and  $R_4$ ,  $R_5$  given off from stalk of  $R_3$  and  $R_4$ , areole very long, discocellulars gently incurved between  $M_1$ - $M_2$  and  $M_2$ - $M_3$ . Hindwing with discocellulars angled inward between Rs and  $M_1$ ,  $M_3$  and CuA<sub>1</sub> separate.

♂ genitalia. Uncus long, a little expanded towards apex, apex pointed, gnathos with spinulose center, furca asymmetrical, apical area usually spinulose, valva ample, without inner decoration, sacculus absent, aedeagus straightish, simple, cornutus not developed. ♀ genitalia. Colliculum sclerotized into a pair of bands, ductus bursae very short, corpus bursae ovate or elliptical, with a large disc-like signum.

*Distribution.* Northeast India, North Myanmar, China, Taiwan, Korea, Japan.

*Auaxa cesadaria* Walker (Figs. 1-6)

*Auaxa cesadaria* Walker, 1860 : 271 (China. In Mr. Saunder's collection); Prout, 1915 : 329, pl. 16 : d ; Wehrli, 1940 : 338.

*Auaxa sulphurea* (part.) : Leech, 1897 : 220, nec Butler, 1878.

The largest species among congeners, hindwing with crenulation of termen very weak, both wings with postmedian lines thick, its distal shading on hindwing very weak or vanished, discocellular dot and antemedian line on forewing usually vestigial, fringes dotted with dark brown at extension of veins. Length of forewing : ♂ 21-25 mm (aver. 22.7 mm, 6 exs.), ♀ 23-25 mm (aver. 24.0 mm, 3 exs.).

♂ genitalia (Figs. 17-18). Uncus very thick, only left furca developed, a broad stick-like process with rounded tip, extending a little beyond base of costa, only apical area spinulose, aedeagus rather short and broad. ♀ genitalia (Figs. 27-28). Signum strongly serrated at margin, without thick rim for the other species.

*Specimens examined.* Holotype, ♀ : China, Type Lep. : No. 1095 (abdomen missing), Hope Dept., Oxford. China : Hoeng-shan, 900 m, Prov. Hunan, 1933, 1 ♂ (H. Höne); Kuatun, 2300 m, Fukien, 18. vi. 1938, 1 ♂ (J. Klapperich); Wenchow, Checkiang, vi & vii. 1939, 1 ♂, 1 ♀ (H. Höne); Lienping, S. China, Coll. Wehrli, 1 ♂, ZFMK. Taiwan : Shih-tyuly, Alishan, Chiai Hsien, 12. vii. 1938, 1 ♂ (T. Kano); "Puli", Nantou Hsien, 1963, 1 ♂, 1 ♀ (Native collector), HI.

*Distribution.* South & east China, Taiwan.

The large size, shape of furca and signum distinguish this species from the other congeners dealt with below without difficulty. Specimens from Taiwan are smaller than those from the continental China, but the genitalia in both sexes are perfectly identical.

*Auaxa kaluga* Swinhoe, **sp. rev.** (Figs. 12-14)

*Anaxa* (!) *kaluga* Swinhoe, 1900b : 308 (Jaintia Hills, North India).

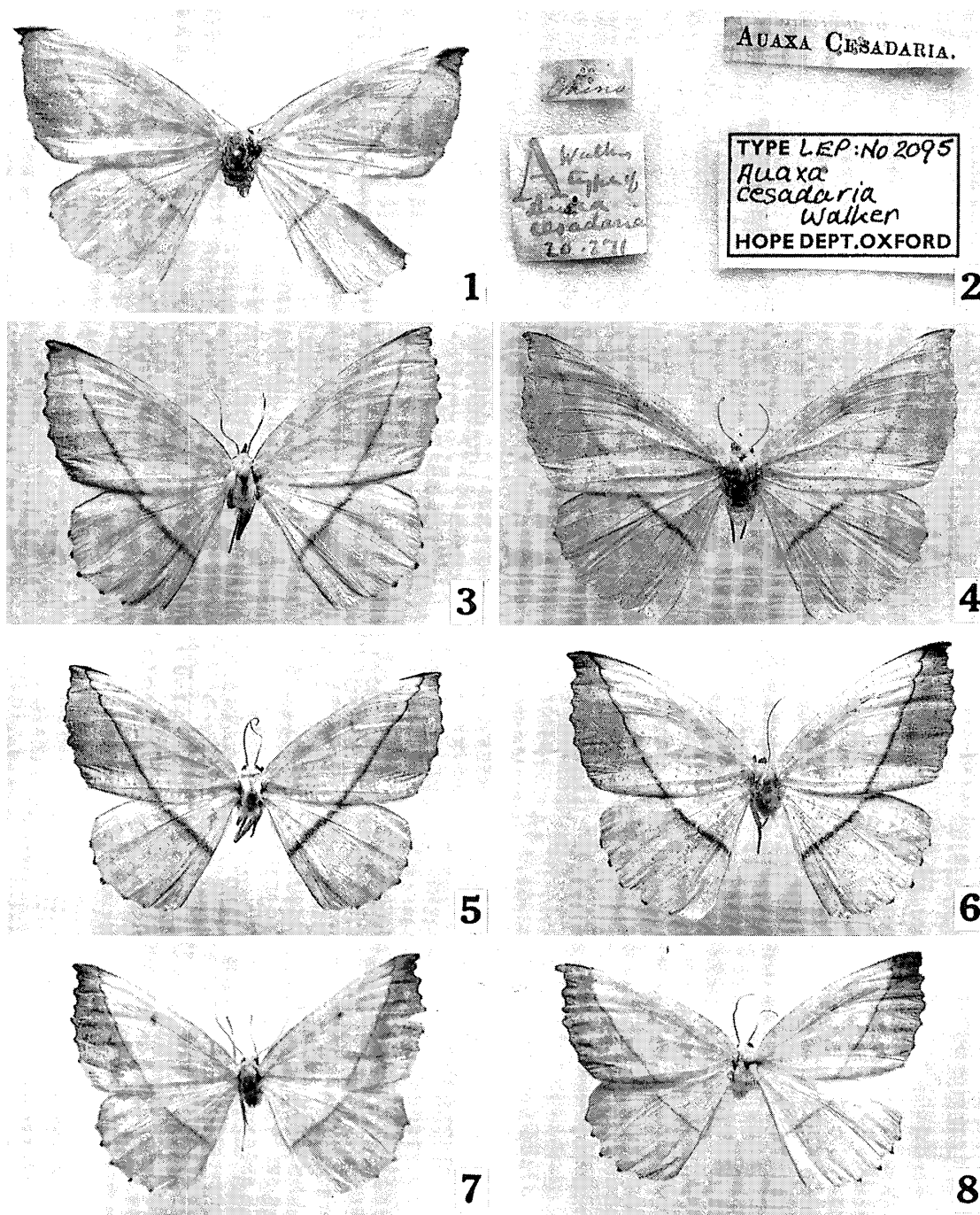
*Auaxa kaluga* : Prout, 1926 : 797.

*Auaxa cesadaria kaluga* : Wehrli, 1940 : 338, pl. 26 : c.

Smaller, ground colour of wings more vivid yellow than in *cesadaria*, postmedian lines thinner, its distal shade on hindwing usually well-marked. Forewing with apex more acutely falcate, especially in ♀, postmedian line closer to apex at costa, more strongly curved at radials, antemedian fascia often clear, but sometimes vanished. Length of forewing : ♂ 17-22 mm (aver. 19.7 mm, 7 exs.), ♀ 19-23 mm (aver. 20.0 mm, 7 exs.).

♂ genitalia (Figs. 19-20). Uncus and valva slenderer than in *cesadaria*, a pair of arms of furca nearly equal in length, but slender left one a little longer, almost reaching base of uncus, spinulose from near base, right one much broader, a short lateral process at two-thirds from base, spinulose at tip, aedeagus slenderer and longer than in *cesadaria*. ♀ genitalia (Figs. 29-30). Band-like colliculum slenderer than in *cesadaria*, signum an elliptical ring, opened at caudal end, margin not serrated as in *cesadaria*.

*Specimens examined.* Holotype, ♀ : North India, Jaintia Hills, 1900 : 250, BMNH; Khasis, June 1985, Nat. Coll., 2 ♀, BMNH. Myanmar : Hpimaw Fort, N. E. Burma, 800 ft. vi. 23, AES viii., 1 ♀ (recorded by Prout, 1926), BMNH. China : Li-kiang, Prov. Nord-Yunnan, 11 & 23. vii. 1934, 1 ♀; *ditto*, 8-15. viii. 1936, 3 ♂; A-tun-Tse, Nord Yunnan, 16. viii. 1936, 1 ♂; *ditto*, 3. ix. 1936, 1 ♀; Batang (Tibet), Im Tal des Yangtze, 2800 m, 6. vii.

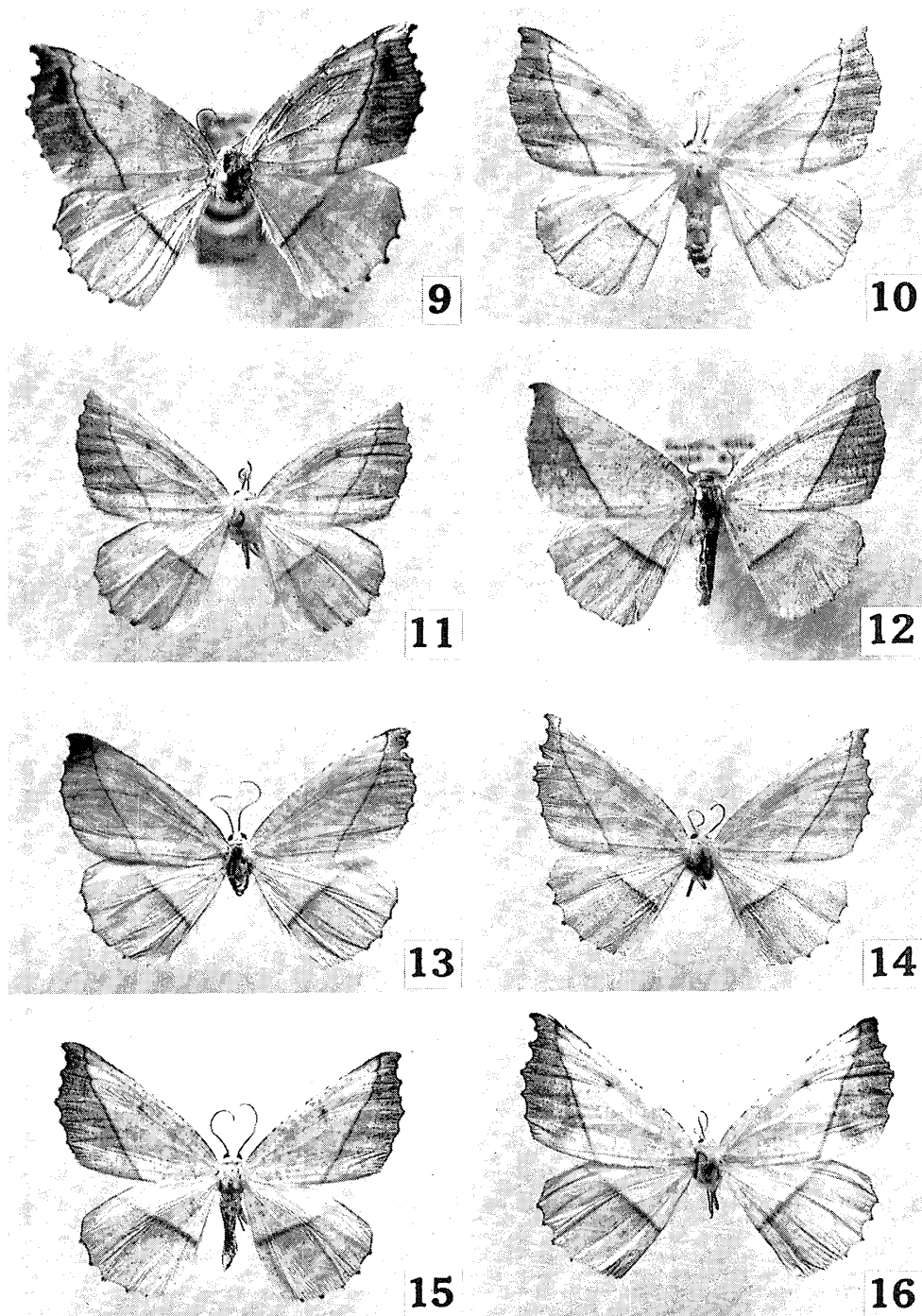


Figs. 1-8. *Auaxa* spp. 1. *A. cesadaria* Walker, holotype ♀. 2. *Ditto*, labels. 3. *Ditto*, ♂, from Lienping, China. 4. *Ditto*, ♀ from Wenchow, China. 5. *Ditto*, ♂, from Taiwan. 6. *Ditto*, ♀ from Taiwan. 7. *A. lanceolata* sp. nov., holotype ♂. 8. *Ditto*, paratype ♀.

1936, 1 ♂; *ditto*, Untere Urwaldzong, ca. 3800 m, 5. x. 1936. 1 ♀ (H. Höne), ZFMK; Tali, Haut Yunnan, Ex. Coll. Ed. Brabant, 1 ♂, BMNH.

*Distribution.* Northeast India, North Myanmar, Southwest China.

There seems to be seasonal variation, because the specimens secured in October have distal brown area darker and more heavily marked than those collected in June and early July.



Figs. 9-16. *Auaxa* spp. 9. *A. sulphurea* (Butler), holotype ♀. 10. *Ditto*, ♂. 11. *Ditto*, ♀. 12. *A. kaluga* Swinhoe, holotype ♀. 13. *Ditto*, ♂, from Likiang, China. 14. *Ditto*, ♀, from Khasis. 15. *A. mimosina* sp. nov., holotype ♂. 16. *Ditto*, paratype ♀.

*Auaxa sulphurea* (Butler), **sp. rev.** (Figs. 9-11)

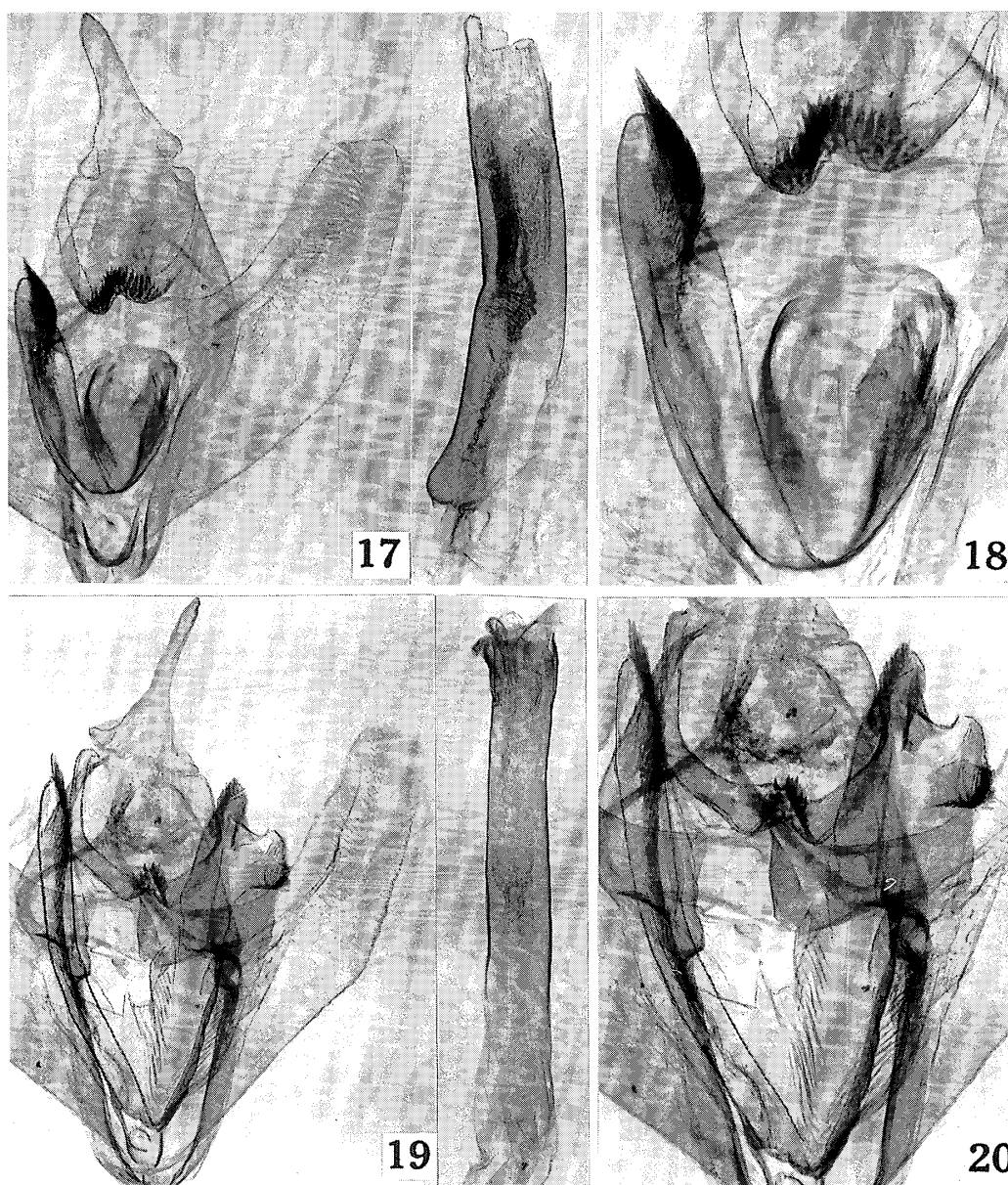
*Bizia sulphurea* Butler, 1878 : 47, pl. 35 : 10 (Japan).

*Auaxa sulphurea* : Leech, 1897 : 220 ; Wileman, 1915 : 352, pl. 2 : 1-4.

*Auaxa cesadaria* (part.) : Swinhoe, 1900a : 254 ; Prout, 1915 : 392.

*Auaxa cesadaria* var. *sulphurea* : Wehrli, 1940 : 338.

*Auaxa cesadaria sulphurea* : Inoue, 1956 : 352 ; id. 1982 : 566, pl. 105 : 22, 23 ; Miyata, 1983 : 365, (pl. 11 : )B ; Nakajima, 1987 : 106, pl. 43 : 12-14.



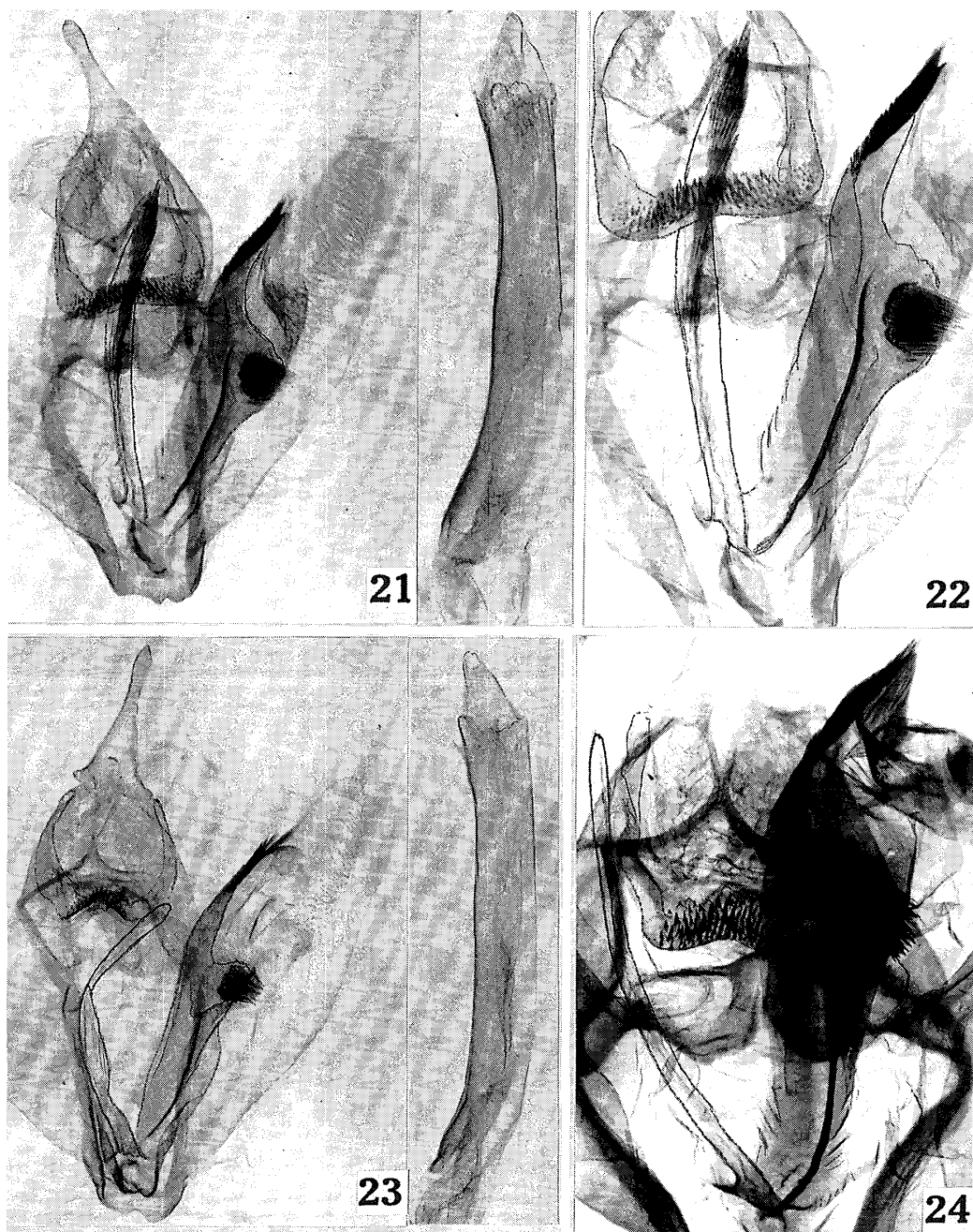
Figs. 17-20. Male genitalia of *Auaxa* spp. 17. *A. cesadaria* (H. Inoue Slide 13283). 18. *Ditto*, furca, greatly magnified. 19. *A. kaluga* (ZFMK). 20. *Ditto*, furca, greatly magnified.

Size nearly as *kaluga*. Confusingly alike *kaluga* in colour and maculation, but postmedian line usually farther from apex at costa of forewing, weakly bent below  $CuA_1$ , while in *kaluga* it is almost straight to hindmargin and on under surface it is very often forked below  $CuA_2$ . Length of forewing: ♂ 18-19 mm (aver. 18.0 mm, 4 exs.), ♀ 20-21 mm (aver. 20.5 mm, 9 exs.).

♂ genitalia (Figs. 21-22). Uncus thicker than in *kaluga*, but slenderer than in *cesadaria*, gnathos with central spinous part longer, straightish, left arm of furca nearly as in *kaluga*, but right arm broader, lateral protuberance at near center much broader, while in *kaluga* the protuberance is far above center, more weakly spined. ♀ genitalia (Figs. 31-32). Signum usually longer than in *kaluga*, though its size is not constant.

*Specimens examined*. Holotype, ♀: Japan, 77.9, BMNH. Korea: Gensan, July, 1887, 1 ♀ (recorded by Leech, 1897), BMNH; Gwangrung, 4. vii. 1973, 1 ♀ (K. T. Park); Baekdenk,





Figs. 21-24. Male genitalia of *Auaxa* spp. 21. *A. sulphurea* (HI Slide 13278). 22. *Ditto*, furca, greatly magnified. 23. *A. mimosina* (HI Slide 13281). 24. *Ditto*, furca, greatly magnified (HI Slide 14563).

4. vii. 1981, 1 ♂ (Y. H. Shin), HS. Japan : Miyahama, Kabemura, Oshima, Hokkaido, 4. viii. 1963, 1 ♀ (S. Sakai) ; Karuizawa, Nagano Pref., 19. viii. 1945, 1 ♀ (H. Inoue) ; Tarôbô, 1400 m, Mt. Fuji, 4. viii. 1970, 1 ♂, 1 ♀ (T. Miyata) ; Kagosaka Pass, near Mt. Fuji, 13. viii. 1969, 1 ♀ (H. Inoue) ; Kiyosato, Yamanashi Pref., 29-31. viii. 1970, 1 ♀ (H. Inoue) ; Takao-san, Tokyo, 17. vi. 1950, 2 ♂ 1 ♀ (H. Inoue) ; *ditto*, 14. vi. 1952, 1 ♂ 1 ♀ (K. Jinbo) ; Bushi, Iruma City, Saitama Pref., 29. vi. 1975, 1 ♀ ; Yokohama, 3. vi. 1951, 1 ♀ (H. Inoue) ; Ôdaru Spa, Izu Pen., Shizuoka Pref., 21. vi. 1961, 1 ♂ (H. Inoue) ; Kitanokawa, Kôchi Pref., 5. vi. 1958, 1 ♀ (S. Nakamura), HI. China : Mokanshan, Prov. Chekiang, 1930, 1 ♀ ; West-Tien-Mu-Shan, 1600 m, Pz. Chekiang, 8 & 25. vi. 1932, 1 ♂ 1 ♀ ; Hoeng-Shan, 900 m, Pz.

Hunan, 23. v. 1933, 1 ♂; Lungtan, Nanking, Prov., Kiangsu, 29. v. 1933, 1 ♂; Mien-Shan, ca. 2000 m, Prov. Shansi, 6. vii. & 7. viii. 1937, 2 ♂ (H. Höne); Peking, Wolberge, Exp. Stötzner, 1 ♀; Szetchwan, Yahotal, Exp. Stötzner, 1 ♂; Kunkalaschan, Szeschwan, 1 ♂; Canton, 1 ♂, ZFMK.

*Distribution.* Japan (South Hokkaido, Honshu, Shikoku, Kyushu), North & south Korea, East China.

In Japan the adult appears in June and August, but seasonal differences in size and coloration are not witnessed from my personal collection.

Wileman, 1915, described and illustrated larvae of this species reared from *Rosa multiflora*, wild rose, in Japan. Mature larva is pale green with six pairs of curved pink spines, dexterously mimicking a young twig of the wild rose. Miyata, 1983, and Nakajima, 1987, also showed colour photographs of mature larvae on the same plant.

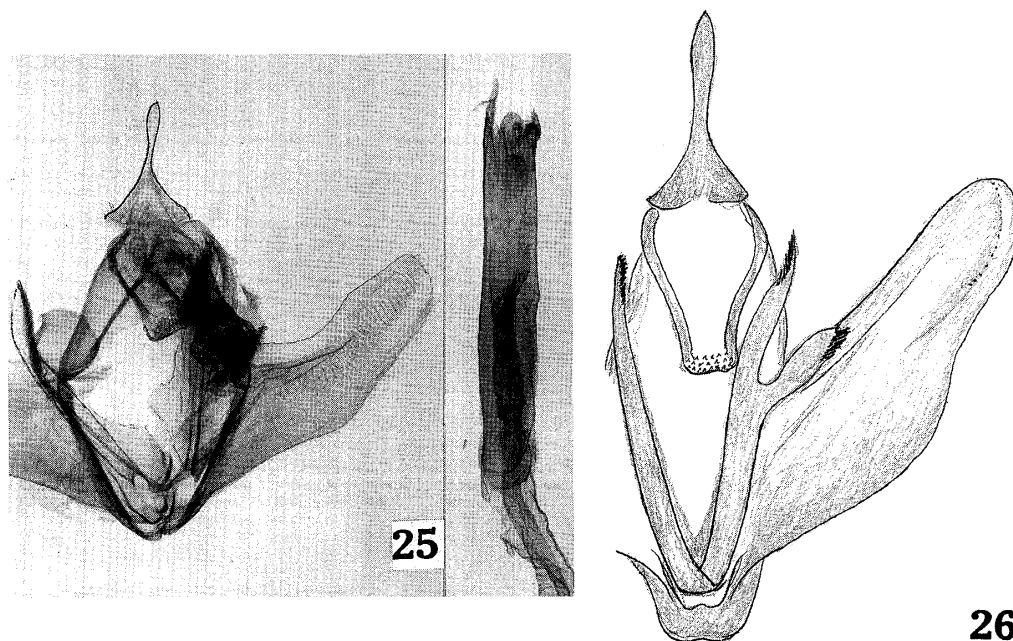
***Auaxa lanceolata* sp. nov. (Figs. 7-8)**

It is nearly impossible to distinguish this new species from *sulphurea* and some specimens of *kaluga* in colour and maculation. Postmedian lines usually as slender as in *kaluga*, discocellular spot of forewing as in *sulphurea*. Size almost identical with *sulphurea*.

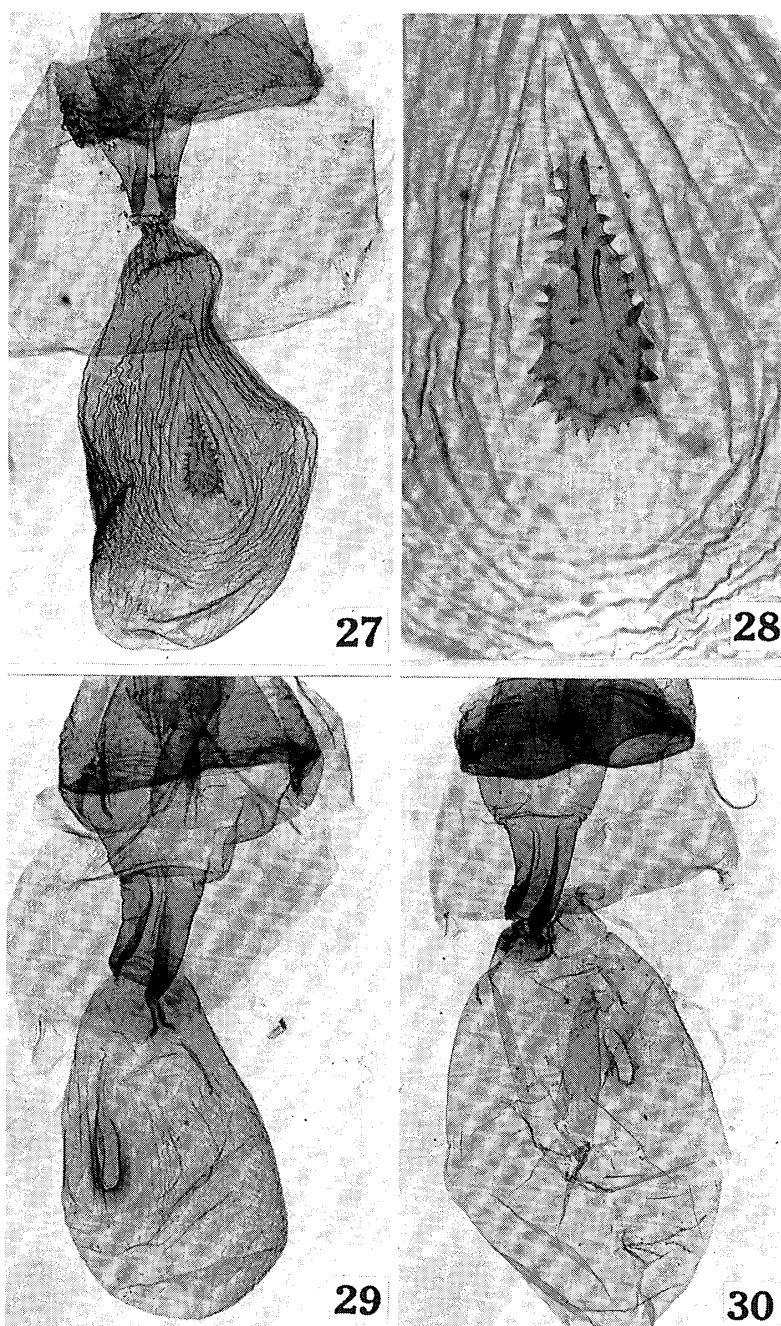
♂ genitalia (Figs. 25-26). Uncus slenderer and arms of furca shorter than in *sulphurea*, not reaching base of uncus, the protuberance of right arm placed a little above middle, smaller than in *sulphurea*, valva a little narrower. ♀ genitalia (Fig. 33). Signum lanceolate, much longer than in *kaluga* and *sulphurea*, its length usually over a double length of *sulphurea*.

Holotype, ♂: Ta-tsien-Lou, 1910 (Chassurs indigènes), ex Oberthür Coll., Brit. Mus. 1927-3, BMNH. Paratypes. China: Thibet, Tchang-kou (Chasseurs Chinois), Ete 1892, 1 ♀, ex Oberthür Coll., BMNH; Hoeng-Shan, 900 m, Provinz Hunan, 24. v. 1933, 1 ♀; Lungtan bei Nanking, Prov. Kiangsu, 8. vi. 1933, 1 ♀; Mien-Shan, ca. 2000 m, Prov. Shansi, 5. vii. 1937, 1 ♀ (H. Höne), ZFMK.

*Distribution.* East, south & west China.



Figs. 25-26. Male genitalia of *Auaxa lanceolata*. 25. Tibet (BMNH). 26. Yunnan (BMNH).



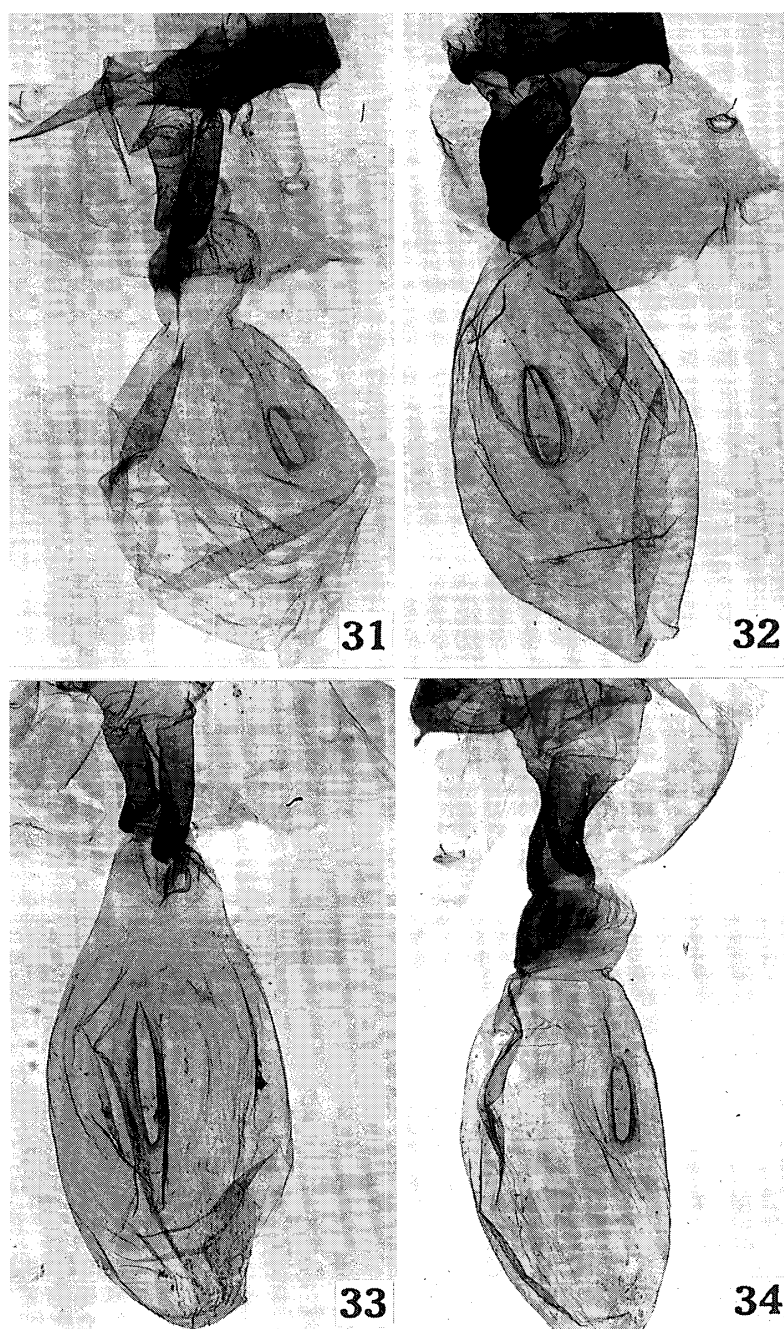
Figs. 27-30. Female genitalia of *Auaxa* spp. 27. *A. cesadaria* (HI Slide 13282). 28. *Ditto*, signum, greatly magnified. 29. *A. kaluga* (ZFMK). 30. *Ditto* (ZFMK).

***Auaxa mimosina* sp. nov.** (Figs. 15-16)

Again closely resembles *sulphurea* and *lanceolata* in external characteristics. Ground colour more vivid than in *sulphurea*. The reddish brown distal area of forewing usually darker than in the two species cited above, but sometimes there are strongly marked specimens in the two species. The postmedian line of forewing more straightish at radials than in *sulphurea*, but rarely curved or angled there, closer to apex at costa. Length of forewing: ♂ 19-21 mm (aver. 20.0 mm, 10 exs.); ♀ 20-21 mm (aver. 20.8 mm, 4 exs.).

♂ genitalia (Figs. 23-24). Distinguished from *sulphurea*, *kaluga* and *lanceolata* by





Figs. 31-34. Female genitalia of *Auaxa* spp. 31. *A. sulphurea* from Japan (HI Slide 13290). 32. *Ditto* from Korea (HI Slide 14562). 33. *A. lanceolata* (ZFMK). 34. *A. mimosina* (HI Slide 14564).

almost naked and slender left arm of furca, right arm with the lateral protuberance arising from a little above middle, aedeagus slenderer than in *sulphurea*, gnathos with central spinous area narrower. ♀ genitalia (Fig. 34). Signum narrower than in *sulphurea*, but shorter than in *lanceolata*.

Holotype, ♂ : Kuanyuan, 2400 m, Hualien Hsien, Taiwan, 25. vi. 1989 (M. Owada), in coll. National Science Museum, Tokyo. Paratypes. Taiwan: data as holotype, 2 ♂ ; Sungkang, 2000 m, Nantou Hsien, 31. v. 1965, 2 ♂ 3 ♀ (T. Shirôzu) ; Alishan, Chiai Hsien, 20. vi. 1970. 1 ♀ (Y. Kishida) ; Hohuanshan, 3100 m, 20. vii. -1. viii. 1983. 1 ♀ (A. Kawabe) ;

Tayuling, 2560 m, 12. vi. 1988, 1 ♂ (M. Ihara); Nantou Hsien, 1963 & 1968, 4 ♂ (native collectors), HI.

*Distribution.* Taiwan.

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## 摘 要

鱗翅目シャクガ科エダシャク亜科にぞくする *Auaxa* 属の再検討 (井上 寛)

*Auaxa* は、日本、朝鮮半島、中国大陸、インド亜大陸と分布する小さな属で、Wehrli (1940)の研究以来、中国を基産地とする *A. cesadaria* Walker という単一の種によって代表され、日本からの標本で記載された *A. sulphurea* (Butler) キエダシャクと、インド東北部の *A. kaluga* Swinhoe は、*cesadaria* の地理的変異とされていた。今回の研究によって、上記の3つのタクサがそれぞれ独立種であることが判明すると共に、中国大陸と台湾にそれぞれ一新種の存在することが発見された。日本のキエダシャクの成虫については、井上, 1982, 日本産蛾類大図鑑 1: 566; 2, pl. 105: 22, 23 を、幼虫については、中島, 1987, 日本産蛾類生態図鑑: 106, pl. 43: 12-14 を参照されたい。

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